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Epidemiological data and ranking home and leisure accidents for priority-setting

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Abstract

Objective: To determine how to use the multitude of available epidemiological data to rank accidents for prioritisation of prevention. **Methods:** A stepwise method to rank accidents for priority-setting at any time is proposed. The first step is to determine the overall objectives of injury prevention. Based on these objectives, the relevant epidemiological criteria are determined. These criteria need to be weighed by experts in such a way that these weights can be used for every new cycle of priority-setting. Thus, every time the method is applied: first, the relevant types of accidents are identified; second, the epidemiological criteria are determined per type of accident; and third, the types of accidents are ranked by means of standardised weights per criterion. The proposed indirect method is illustrated by an empirical example. The results were compared with a direct method, i.e. ranking by an expert panel. **Results:** In the pilot, we ranked four age groups of victims of a home and leisure accident: 0–4, 4–19 and 20–54 years of age, and victims aged 55 years or older. The resulting rankings differ largely per application; number one are victims older than 55 years or those of 20–54 years. **Conclusions:** The proposed method enables a structured, transparent way to set priorities for home and leisure accidents. It is a promising method, although further development is clearly necessary, based on the actual application of the model. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Priority-setting; Methods; Injury epidemiology; Indicators

1. Introduction

Worldwide, injuries are leading causes of death in all age groups (97.9 per 100 000 inhabitants). Almost one-quarter of these injuries are related to falls, drownings, fires and poisonings (Krug, 1999). In the Netherlands each year, approximately 17 injuries per 100 inhabitants are medically treated; three-quarters of these are home and leisure accidents (den Hertog et al., 1997). The direct medical costs of injury constitutes 4% of all direct medical health care costs (Polder et al., 1997). Two-thirds of these costs are related to home and leisure accidents (Meerding et al., 2000). The costs of absenteeism due to injuries is estimated for the Netherlands at NLG 530–760 million per annum (i.e. 240–350 million Euros; van Beeck et al., 1997).

Setting priorities for injury prevention is necessary, as resources set aside for one purpose will not be available for another. It has to be regularly decided which types of accidents should be paid attention to. This could be a choice between main groups (e.g. accidents involving elderly people compared with those involving children) or between subgroups, such as poisonings and drownings involving children or, even more detailed, poisonings involving pharmaceuticals compared with poisonings involving household chemicals. The criteria for priority-setting can be related either to the size and severity of the injury at issue, or to the expected impact of preventive interventions.

So far in the Netherlands, only one study has been conducted on priority-setting in the field of home and leisure accidents. Thien (1994) applied a multicriteria analysis in order to determine the areas of interest most relevant to the prevention of home and leisure accidents. However, at the moment, no structured method is available in the Netherlands to set priorities in injury

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prevention ‘at any time’ (i.e. not for use only once, but whenever there is a need for it). Although other attempts have been made to develop an overall method for priority-setting in the field of accidents to be used at any time (Williams, *sans annee*, Wottawa and Kisser, 1995), the methods have not been applied in practice.

Until now, priority-setting has been carried out implicitly by decision-makers, and not in a structured way by including all relevant alternatives and available information. Although this does not necessarily imply that wrong choices are being made, it does mean that some issues might be overlooked or are receiving too little attention. Our aim is to develop a structured and reproducible method by which priorities can be set with regard to preventive measures for home and leisure accidents in a transparent way, in principle at any given moment, including all relevant aspects.

The objective of this paper is to present a sound method (by means of a stepwise approach) with which to sort out the multitude of epidemiological data and determine how to use them to rank accidents for priority-setting. The proposed method is illustrated by an empirical example.

2. Method

Priority-setting in injury prevention consists of two closely connected phases: (1) the selection of accidents that should be prevented, and (2) the selection of interventions that should be implemented. These phases depend on epidemiological information and the characteristics of the available interventions, respectively.

The factors that play a role in setting priorities concerning home and leisure accidents can be summarised into two main groups: (1) epidemiological criteria, and (2) intervention criteria. Epidemiological criteria refer to the magnitude of the problem (e.g. incidence rate) and the severity of the injuries (e.g. costs and long-term consequences). Various factors influence the decision on how desirable it is to implement an intervention: an intervention should be suitable, efficient and effective. Suitability, for example, depends on the acceptability within society to a preventive measure, the availability of preventive measures, and consumer perceptions of the type of risk involved.

Ideally, setting priorities in injury prevention would be structured as follows.

Phase 1. Select the types of accidents (i.e. alternatives) that are ‘potentially relevant to injury prevention’ by taking into account available epidemiological criteria and available information

on the options for intervention (intervention criteria).

Phase 2. Select the types of accidents that are ‘potentially open to effective intervention’ by taking into account additional information on the backgrounds of the type of accidents and intervention criteria.

Phase 3. Generate ‘possible intervention strategies’ for the selected alternatives based on additional research (if necessary).

Phase 4. Decide which ‘interventions will be implemented’.

Basic epidemiological data play a role in the first step only, while information on the options for intervention is relevant to all four steps of the process of priority-setting. Applying and combining both epidemiological and intervention criteria on several types of accidents will lead to a ranking order of these accidents, including their feasible interventions.

This paper focuses on the role of epidemiological criteria in priority-setting; whether the accidents can indeed be prevented effectively or whether interventions can actually be implemented is not within the scope of this paper. Thus, we artificially separate the epidemiological criteria and the intervention criteria, and limit the process of ranking types of home and leisure accidents by using only epidemiological data. We assumed that the first phase in ranking the types of accidents should be based on epidemiological criteria, while only after this phase should the intervention criteria be included. This choice was not just a pragmatic approach: unravelling the two sets of criteria leads to a more transparent inclusion of the arguments of the discussion on prioritisation.

There is considerable literature on priority-setting methods in health care, but these methods are especially suitable for priority-setting only once and not at any time. What is needed is a method with which to set priorities continuously. From the literature on priority-setting in health care (for example de Pater, 2000; Ham, 1997; van der Beek et al., 1997; Dunning, 1996; Murray and Lopez, 1996; Ruwaard and Kramers, 1997; Wottawa and Kisser, 1995; Brown and Redman, 1996; Thien, 1994; Covello and Merkhofer, 1993; Williams, *sans annee*, Ministerie van Financiën, 1993), we extracted a framework for ranking alternatives for injury prevention as presented in Fig. 1.

Fig. 1 shows that the final stepwise method for ranking alternatives (i.e. types of accidents) depends on the answers to four questions.

1. What are the objectives for priority-setting?
2. Which alternatives should be ranked?
3. Which epidemiological criteria are available?
4. How should these criteria be weighed?

2.1. Objectives

Priorities have to be set regularly (several times per year) for different sets of accidents. This means that the method has to cope with that aspect and that it should therefore be possible to use the method at any given time, rather than only once.

The choice of epidemiological criteria depends on the overall target for priority-setting. The policy of governments and governmental organisations on injury prevention is often to maximise health benefits on the level of society (Ministerie van VWS, 1998; DHFS and AIHW, 1998; CPSC, 2000). In that case, the method must lead to a ranking order for types of accidents with the largest potential for overall health benefits, including social and financial costs. This means that the epidemiological criteria to be included in the method have to be indicators for potential health benefit (e.g. lost years of life). Another objective would need another set of epidemiological criteria.

2.2. Alternatives

As it must be clear how many alternatives should potentially be included in the priority process, we distinguished two options.

1. Including the entire field of home and leisure accidents. This option is relevant for determining (home and leisure) injury prevention policy as a whole and will be applied to the major groups of types of accidents (e.g. age groups), and only once every couple of years for, for instance, multi-annual strategy documents of ministries or organisations responsible for injury prevention.
2. Including a limited number of types of home and leisure accidents. This option is relevant, for in-

stance, to annual programmes designed to detect relevant projects or to decisions to be taken within projects. An example is prioritising poisonings in children compared with drownings in children.

The method needs to be applicable in both situations: ranking all possible alternatives versus ranking a limited number of alternatives.

The alternatives need to be described in such a way that they are rather homogeneous in relation to interventions. This is necessary because of the next phase in priority-setting, i.e. the application of intervention criteria to alternatives ranked by means of epidemiological criteria. Only when alternatives are described as 'recognisable' types of accidents can intervention criteria be applied in a meaningful way.

2.3. Epidemiological criteria

The epidemiological information on accidents from routine data sources currently available in the Netherlands is presented in Table 1. This information is available for the total group of home and leisure accidents, and also for subgroups. The classification used for the relevant data sources limits the composition of the subgroups (more or less detailed). For fatalities and hospital admissions, information is available for all groups that can be identified by means of the International Classification of Diseases (ICD) (WHO, 1977, 1992). The ICD is a uniaxial classification with a relatively small number of codes for home and leisure accidents. For attendances at emergency departments, the classification of the Dutch Injury Surveillance System (LIS) (an injury surveillance system at emergency departments of 17 hospitals; Consument en Veiligheid, 2000) can be used. This is a multiaxial classification especially designed for injuries and includes various data elements relevant to home and leisure accidents. Information on injuries treated by general practitioners in the Netherlands is collected by a 5-yearly household survey on accidents (Mulder et al., 1995; den Hertog et al., 2000).

2.4. Weighing the criteria

If there is more than one epidemiological criterion, the criteria need to be weighed (Fig. 2). This could be carried out by experts during, for instance, a group session or a paper procedure. It is too time-consuming to weigh the epidemiological criteria for every application of the method. Therefore, ideally, the weighing factors have to be determined only once and be applicable to every application of the method. These standard weights need to be generated by experts through a formal procedure. The experts have to rank a number of alternatives from which they get the epidemiological

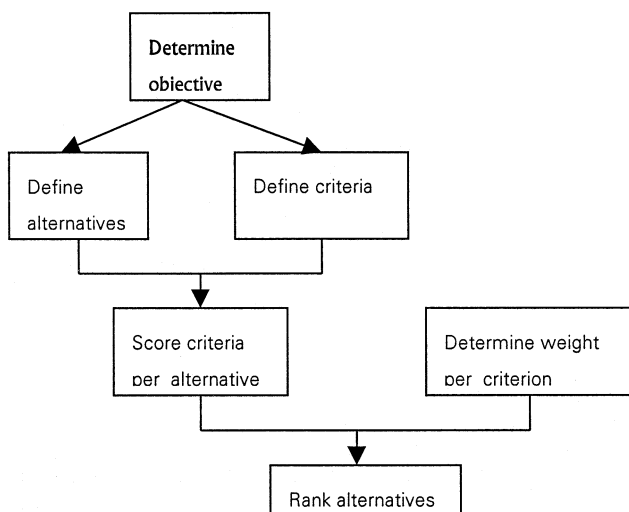


Fig. 1. Basic procedure for ranking alternatives.

Table 1

Epidemiological data currently available in the Netherlands on types of home and leisure accidents per health care sector

Available epidemiological information on home and leisure accidents	Health care sector			
	Deaths ^a	Hospital admission ^b	Emergency department ^c	General practitioner ^d
<i>Incidence</i>				
Number of cases	X	X	X	X
Incidence per 100 000 inhabitants	X	X	X	X
Trends in incidence	X	X	X	X
<i>Direct medical costs</i>				
Total direct medical costs	–	–	X	–
Direct medical costs per injury patient	–	–	X	–
<i>Severity</i>				
% Hospital admissions	–	–	X	–
Total number of admission days	–	X	–	–
Average number of days of admission	–	X	X	–
Lost life years	X	–	–	–
% Fractures	–	–	X	–

^a Based on Death Statistics, Statistics Netherlands, ICD (WHO, 1977, 1992).^b Based on Dutch Information System on Hospital Care and Day Nursing (LMR), Prismant, ICD (WHO, 1977).^c Based on LIS, Consument en Veiligheid, own classification (Consument en Veiligheid, 2000).^d Based on household surveys 'Accidents in the Netherlands', own classification (van Montfoort et al., 1988; Mulder et al., 1995; den Hertog et al., 2000).

features. To prevent the experts from taking into account intervention criteria, the actual description of the alternatives should be withheld.

To compare the available epidemiological criteria for the alternatives to be ranked, indices are helpful (Fig. 2). These indices can be calculated for any alternative by multiplying the weights by the value of epidemiological criteria and adding them. The higher the index, the higher the type of accident on the priority list.

After the weights are determined per epidemiological criterion, the method can be applied at any selection of accidents. In summary, every time the method for priority-setting is applied: first, the relevant types of accidents (the alternatives) are generated; second, the epidemiological criteria are determined per alternative; and third, alternatives are indexed by means of standardised weights.

In addition to the theoretical outline of the method, the proposed method was applied and compared with other methods. As a pilot, we decided to determine how much attention should be paid to the different age groups of the victims covering the entire field of home and leisure accidents, with the overall objective that injury prevention should maximise health benefits. The composition of the alternatives to be prioritised (i.e. the age groups) are mainly based on homogeneity concerning the intervention channels via which they can be reached (e.g. 0 to 4 year olds through mother and child health centres, 5 to 19 year olds through school).

The four age groups were ranked by three different methods: (1) a direct method just including results from LIS; (2) a direct method not just based on information from LIS, but on all epidemiological information available; and (3) an indirect method including information from LIS, but with explicitly determining weights for each epidemiological indicator as an intermediate step. These three methods were applied, in order to compare the results of methods (1) and (2) (limited information available versus all information), and the results of methods (1) and (3) (direct versus indirect).

For the direct methods, two multidisciplinary panels of eight and nine experts in injury prevention (including epidemiologists, technical researchers, educational consultants and policy-makers), respectively, each ranked the age groups in a group session. The discussions were basically limited to potential health benefits, and not based on expectations on the effectiveness of preventive interventions.

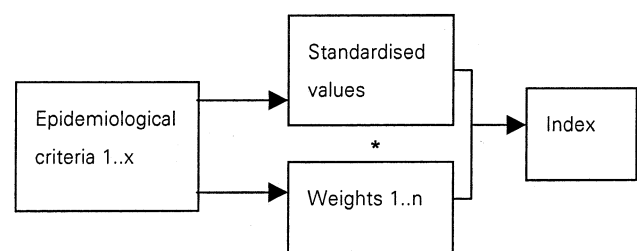


Fig. 2. Process of indexing a type of accident based on epidemiological data.

Table 2
Epidemiological information on home and leisure accidents in the Netherlands by age group^a

Epidemiological information ^b	Age group				Total
	0–4 years	5–19 years	20–54 years	55+	
<i>Number of cases^c</i>					
*Emergency department ^d	67 000 (4)	236 000 (2)	353 000 (1)	122 000 (3)	778 000
Hospital admissions ^e	5800 (4)	11 900 (3)	26 900 (2)	34 900 (1)	79 600
Fatalities ^f	55 (3)	45 (4)	300 (2)	1700 (1)	2100
General practitioner ^g	151 000 (4)	308 000 (2)	528 000 (1)	235 000 (3)	1 220 000
<i>Incidence per 100 000^c</i>					
*Emergency department ^d	6900 (2)	8500 (1)	4400 (3)	3500 (4)	5100
Hospital admissions ^e	600 (2)	430 (3)	330 (4)	1000 (1)	520
Fatalities ^f	6 (2)	2 (4)	4 (3)	50 (1)	14
General practitioner ^g	15 500 (1)	11 100 (2)	6500 (4)	6800 (3)	8000
<i>Trend (%)^{c,h}</i>					
*Emergency department ^{d,i}	+13 (2)	+5 (4)	+7 (3)	+19 (1)	+11%
Hospital admissions ^{e,i}	+16 (1)	+6 (3/4)	+6 (3/4)	+15 (2)	+6%
Fatalities ^{f,j}	–41 (4)	–17 (3)	–5 (2)	+4 (1)	–14%
<i>Direct medical costs^{i,k}</i>					
*Total (million NLG)	53 (4)	177 (3)	417 (2)	843 (1)	1.5
*Per injury patient (NLG)	904 (3)	839 (4)	1150 (2)	6480 (1)	2000
<i>Lost life years^f</i>					
Number	4100 (3)	3100 (4)	11 700 (1)	11 500 (2)	30 400
Number per 100 000	430 (1)	110 (4)	150 (3)	340 (2)	200
<i>Severity</i>					
*% Fractures ^d	17 (3/4)	24 (2)	17 (3/4)	44 (1)	23
*% Admissions of ED attendances ^d	6 (2)	3 (4)	4 (3)	19 (1)	6
*Average number of days hospital admission for LIS ^d	5.2 (4)	5.7 (3)	8.1 (2)	21.5 (1)	14.2
Average number of days hospital admission for LMR ^e	5 (3/4)	5 (3/4)	7 (2)	20 (1)	12

^a Ranking number per criterion is presented in parentheses. * Information from LIS.

^b Except for trends, LMR and LIS data are based on 5-year averages (1992–1996). For the fatalities, the average is based on 1992–1995.

^c There is overlap between categories, e.g. the number of emergency department (ED) attendances includes victims admitted into hospital after treatment at the ED.

^d Source: Dutch Injury Surveillance System (LIS), Consumer Safety Institute.

^e Source: LMR, Prismant.

^f Source: Death statistics, Statistics Netherlands.

^g Source: van Montfoort et al. (1988), Mulder et al. (1995), den Hertog et al. (2000).

^h Corrected for age and sex distribution of the Dutch population.

ⁱ Based on data from 1987 to 1996.

^j Based on data from 1987 to 1995.

^k Source: Meeding et al. (2000).

For the third, indirect method, we first determined weights for LIS criteria (see Section 2.3; including all epidemiological information available would have been too complicated for this pilot). Fourteen injury prevention experts (including three from the previous expert panels) individually evaluated 20 sets of seven fictitious accidents, all of which were described only by means of fictitious but realistic values of seven LIS criteria (distributed homogeneously within the scope of real LIS values): score ‘1’ for the highest priority. These weights can be applied at any selection of accidents. In this paper, we used the four selected age groups as an example.

3. Results

Table 2 shows the results of all epidemiological information available for the four age groups of the pilot, including the ranking per criteria based on absolute values.

The group of experts for method (1) received information on seven criteria from LIS (LIS information from Table 2, excluding the total costs, because it is a combination of incidence and cost per victim). Based on this information, the experts concluded in a group session that the number one on the priority list was the group of elderly people (55+). The differences between

the ranking of the other age groups were considered minor.

Based on all epidemiological information available (Table 2), a second panel concluded that most attention should be paid to the risk group of persons over the age of 55. The second group on the priority list turned out to be young children (0–4 years). The differences in ranking between the category 5–19 years old and that of 20–54 years old were found to be minor.

A regression analysis on the results from the experts (the value per indicator on the priority score) included in the third, indirect, method (determining weighing factors) led to standardised regression coefficients that are average weights for the epidemiological criteria. The regression coefficients are standardised because of the different scales for the criteria (Table 3). The weights are applicable to any selection of accidents. The check on the inter-rater reliability (by means of two regression analyses on the first and the last ten scenarios of all respondents) showed no significant difference between the two models. The check on the intra-rater reliability (by means of regression analyses on all respondents) was positive: the average explanation of variance was 64% per model. The conclusion is that the consensus between the experts was sufficient. For the experts, the most important LIS criterion (i.e. highest weight) was the number of injuries treated at an emergency department, followed by trend, costs, incidence rate, and percentage of victims admitted into hospital.

Applying these weights to the epidemiological information on the example of four age groups of home and leisure accident victims in LIS shows, surprisingly, that most attention should be paid to the age category 20–54 years old, followed by that of 5–19 years old (Table 3). Third on the priority list are persons older than 55 years old; young children (0–4 years) are ranked number four, although the difference between these two groups is minor.

4. Discussion

This paper describes a first phase in setting priorities for the prevention of home and leisure accidents. It is limited to epidemiological criteria, such as the size and severity of the home and leisure accidents that occur.

The three methods of prioritising applied to the empirical example of four age groups of victims of home and leisure accidents lead to different rankings. The differences between the two direct methods can be explained by the number of dimensions included: LIS covers only victims attending an emergency department, while all currently available epidemiological information also includes fatalities and hospital admissions. More information leads to a different ranking.

A possible explanation for the difference between the results of the direct and the indirect method is that the experts implicitly bring with them their knowledge about the possibilities for intervention, especially when the differences based on epidemiological data are minor. Another disadvantage of the direct method is that experts are needed for every prioritisation, which is a time-consuming process. Consequently, the direct method is less transparent and less consistent for different selections. The indirect method clearly needs further development; at least the remaining criteria from Table 2 (especially the criteria related to hospital admissions and fatalities) should be added. When additional criteria are to be included in the method, experts have to be consulted again to generate new standardised weighing factors. The ranking of the age groups based on the indirect method seems to be largely influenced by the incidence. That might be due to the relatively large incidence of the selections prioritised in this paper (i.e. age groups). However, further analyses are needed to determine whether the method is applicable for all

Table 3
Regression coefficients and priority scores for epidemiological criteria from LIS (5-year average 1992–1996)^a for four age groups

Criteria	Standardised regression coefficient ^b	Priority score per age group ^c				
		0–4	5–19	20–54	55+	All ages
Number of cases	–0.41	3.9	13.8	20.7	7.1	45.6
Trend (over 5 years)	–0.28	0.5	0.2	0.2	0.7	0.4
Cost per patient	–0.26	0.2	0.2	0.2	1.2	0.4
Incidence rate	–0.13	3.9	4.9	2.5	2.0	2.9
% Hospital admissions	–0.11	0.2	0.1	0.1	0.7	0.2
% Fractures	–0.06	0.1	0.2	0.1	0.3	0.2
Average length of admission	–0.04	0.1	0.1	0.1	0.2	0.2
Priority score (index) ^d		9.0	19.3	23.7	11.8	49.7

^a Except costs (1997) and trends.

^b This model explains 36% of the variance. All coefficients, except for the average length of admission, are significant ($P < 0.01$).

^c The higher the score, the higher the item scores on the priority list.

^d The standard error is 1.9.

selections of types of accidents (e.g. for extremely high and low incidence groups).

An important advantage of applying the indirect method described in this paper to the methods published so far is that the priorities can be set at any time and for all selections of databases: we can regularly set priorities for different selections of accidents using the same standardised weights. The results of the process of priority-setting using epidemiological information indicate which types of accidents should be considered for potential intervention. The higher a type of accident is on the list, the more effort should be put into coming up with an effective preventive intervention. So, prioritisation based on epidemiological information does not provide the final answer, but it helps to guide the line of reasoning.

The proposed method can be applied in various countries/regions. First, the overall objective of (home and leisure) accident prevention in a particular country/region has to be clear. Based on this objective, the relevant and available epidemiological indicators need to be selected. Third, the weights should be calculated per indicator. These weights per epidemiological indicator can be used for prioritising various selections of type of accidents at any time (for the same set of epidemiological indicators).

It can be concluded that the proposed method with standardised weights is a potential sound method to set priorities for (home and leisure) accidents at any time for two or more selections of accidents. Compared with current practice in the Netherlands, as in other countries, the method is more objective and eases the burden placed on experts making such decisions. The results of our pilot suggests that it is worth continuing the development of the method. Special attention should be paid to the influence of the selection of the epidemiological criteria (number, range of values, and mutual dependence), the influence of the selection of experts (e.g. the field of expertise, knowledge of the indicators) on the weights, and a sensitivity analysis on the effect of the epidemiological indicators on the final rankings.

People might assess the value of children higher than adults (in addition to lost life years). Despite the fact that it is not an epidemiological indicator as referred to this paper, it is suggested to check whether 'age of the victim' should be included as a separate criterion to be weighed.

The proposed method to rank home and leisure accidents based on epidemiological information can be extended with intervention criteria.

The classification used for the data sources limits the possible level of detail for the types of accidents to be selected for priority-setting. Especially, a classification like ICD often does not provide enough detail for selecting the alternatives to be prioritised. In the Netherlands, for instance, quite often LIS (which uses a

more specific and multiaxial classification) will be the only standard source with which the necessary selection of alternatives can be made. As a result, for the majority of the alternatives to be prioritised, only one source of epidemiological criteria (i.e. LIS) can be used. This leads to a decrease in the number of epidemiological criteria that can be included in the method for actual priority-setting. This will be similar in most countries.

Several methods to calculate epidemiological indicators for priority-setting in public health are already developed: each has a different scope. To include additional aspects of health benefits, it is recommended to develop additional epidemiological indicators for setting priorities in injury prevention. From the perspective of loss of productivity, for instance, a model on the indirect costs of injuries in the Netherlands could be developed. Another important indicator not yet available in the Netherlands for home and leisure accidents is 'consequences', especially longer term consequences. So far, only proxies are included for determining the consequences of home and leisure accidents per type, such as percentage of hospital admissions. Also composite health status measures, such as the Disability Adjusted Life Years (DALYs) (Murray and Lopez, 1996), should be included in the priority-setting process. Of course, several methods have been developed in the past few years to determine the outcome of injuries (McDowell and Newell, 1996; Murray and Lopez, 1996); unfortunately, so far none is being applied in the Netherlands in a way that can actually be used for priority-setting in the field of accidents, including those in the field of home and leisure accidents.

The availability and quality of epidemiological information for (home and leisure) accidents is yet insufficient to be able to calculate the more complex indicators (like DALYs) for specific types of accidents.

For optimal use of the epidemiological indicators for priority-setting in injury prevention, they have to be linked with the data sources (like emergency department surveillance systems) providing the incidence data (preferably at record level). If more epidemiological indicators become available for inclusion in the method as proposed in this paper, the process will become more complicated; the scope for the use of the priority-setting method, however, will be broader. For specific objectives (like decrease of severe injuries), the method for prioritisation should be applicable to a selection of epidemiological criteria available.

Methodological progress concerning the method of priority-setting in the field of home and leisure accidents will have to be made. But it is clear that a more structured process of setting priorities will lead to more transparent decision-making. This paper reports the first step towards developing such a structure.

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